ABSTRACT

Ruthenium and osmium carbene compounds that are stable in the presence of a variety of functional groups and can be used to catalyze olefin metathesis reactions on unstrained cyclic and acyclic olefins are disclosed. Also disclosed are methods of making the carbene compounds. The carbene compounds are of the formula

$$\begin{array}{c} X & \stackrel{L}{\underset{L^1}{\bigvee}} = C \\ X^1 & \stackrel{L}{\underset{L^1}{\bigvee}} = C \end{array}$$

where M is Os or Ru; R1 is hydrogen; R is selected from the group

consisting of hydrogen, substituted or unsubstituted alkyl, and

substituted or unsubstituted aryl; X and X¹ are independently selected from any anionic ligand; and L and L¹ are independently selected from any neutral electron donor. The ruthenium and osmium carbene compounds of the present invention may be synthesized using diazo compounds, by neutral electron donor ligand exchange, by cross metathesis, using acetylene, using cumulated olefins, and in a one-pot method using diazo compounds and neutral electron donors. The ruthenium and osmium carbene compounds of the present invention may be used to catalyze olefin metathesis

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depolymerization of unsaturated polymers, synthesis of telechelic

reactions including, but not limited to, ROMP, RCM,



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polymers, and olefin synthesis.